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(71) Applicant: **LICENCIA HOLDING S.A.**
35, Boulevard Prince Henri
L-1724 Luxembourg (LU)

(72) Inventor: **Bihlet, Klaus**
Gjerlevvej 13 c/o Torslev
DK-8983 Gjerlev J (DK)
Inventor: **Pedersen, Jorgen**
Poppelvej 4, Assens
DK-9550 Mariager (DK)

(74) Representative: **OLSEN, Peter Vestergaard et al**
LARSEN & BIRKEHOLM APS EUROPAEISK PATENTBUREAU Skagensgade 64, Postbox 200
DK-2630 Taastrup (DK)

(54) Device for tearing-up and stoking straw.

(57) A device for tearing-up and stoking straw into a burner unit has a reciprocating slide (1) provided under a magazine shaft (16) for straw bales (17), the slide (1) having mutually staggered teeth (2) on its upper side (3) in a forward part of the slide (1) and elongated fins (6) extending in the direction of movement of the slide (1) i a rear part. The part closest to the stoking channel (12) is designed as piston means (7) for the conveyance and compression of comminuted straw.

The straw is torn-up already at the initial advance movement of the slide (1) towards the channel (12) because the teeth (2) are in engagement with the lowermost bale (17), whereas the bale (17) is upheld by the teeth (2) and the fins (6) during the return movement of the slide (1). The piston means (7) ensures that the shredded straw (18) is pushed into a stoking channel (12) for the fireplace (15) of a boiler (14). The very compressed straw bales (17) is thereby very uniformly comminuted and compressed before the feeding thereof into a burner unit.

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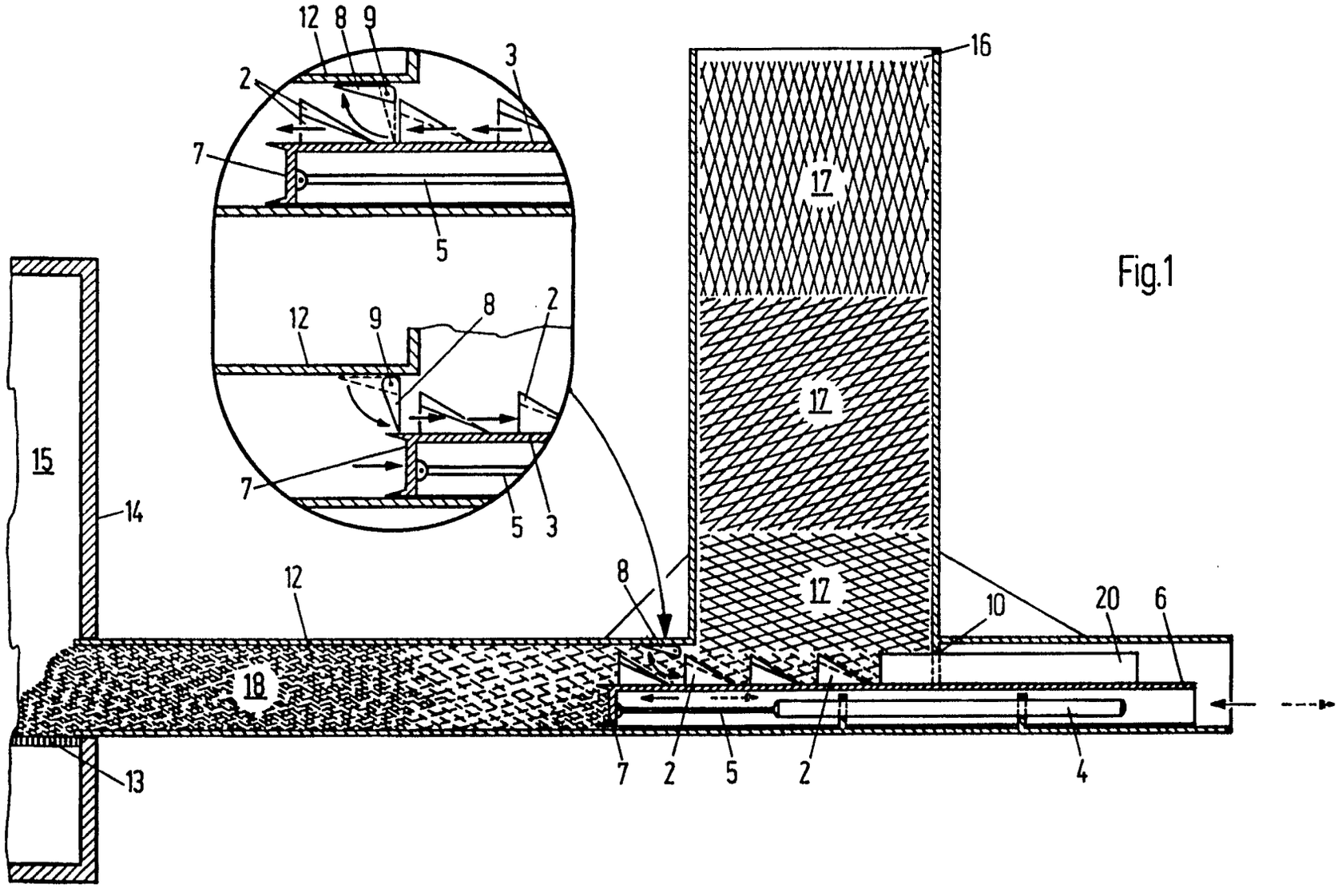

Fig.1

DEVICE FOR TEARING-UP AND STOKING STRAW

The invention concerns a device for tearing-up and stoking straw into a combustion chamber and comprising an essentially vertical magazine shaft for containing a number of straw bales under which shaft an essentially horizontal slide with teeth is movable from one position vertically below the shaft and into a stoking channel and back again.

Devices of this sort are used especially in connection with straw-burning boilers for feeding the boiler with torn-up straw from straw bales.

From DK patent publication no. 134.331 and DK patent application no. 2003/81 there are disclosed devices where the cutting-off process is performed by means of a cutting edge, which by the advance of the slide cuts a slice off the straw bale and pushes it forwards into the stoking channel.

By the known art there is not produced comminuted straw but rather separate blocks cut off the bales. This does not give an even and continuous feeding of the fuel and the combustion of the straw also becomes poorer on account of these straw blocks that are highly compressed due to the baling process. Also, a large amount of power is needed to convey the cutting edge.

To diminish these disadvantages a tearing-up device is disclosed in DK patent application no. 4465/86, said device comprising sawtooth-shaped knives which during their reciprocating movement tear off straw which falls into an underlying hopper and an aggregate for stoking the straw into the combustion chamber. The knives are shaped as mutually parallel saw blades working on the end surface of the straw bale with a sawing motion. This does not give a uniform shredding of the straw and therefore the efficiency is not particularly high on account of this saw-like movement. Thus the power consumption of the device is relatively large compared to the quantity of straw torn off.

The purpose of the invention is to improve the tearing-off process by making it more effective in relation to the power consumed while at the same time the torn-off and conveyed straw has a homogenous consistence regarding to its structure and degree of compression. This is obtained by a device as mentioned in the introduction and where the slide is provided with teeth provided as single upward-facing elements mounted on the slide, the teeth being mutually staggered in the direction of movement of the slide.

Furnishing the slide with such staggered tooth-elements there is achieved a hitherto unknown high efficiency because of the evenly distributed tearing-up over the entire end surface of the bale. Add to this that the straw bale because of its weight will be lowered against the slide resulting in a full tearing-up effect being obtained from the very start of the forward movement of the teeth.

In this way all the teeth will be active during their contact with the straw bale so that the efficiency will be as high as possible. Furthermore, a very uniformly torn-up straw material is attained ensuring a uniformly good combustion.

Besides, the amount of mechanical equipment is reduced as the movements of the slide also pushes the torn-off straw directly into the stoking channel and eventually into the combustion chamber.

While using the device according to the invention the tearing-off can be performed in a continuous way, as the slide may be started and stopped at any place during its reciprocating cycle without impairing the shredding process. This makes possible to vary the flow of straw according to the fuel demand, for example in a heating plant.

According to the embodiment of the invention as stated in claim 2, the lower edge of the shaft may be provided with rods projecting down towards the slide and in such a way that the teeth can pass between the rods. Hereby it is possible to ensure that the torn-off straw only will be carried forward into the stoking channel and not be withdrawn by the return movement of the knives.

By designing the device according to the invention as stated in claim 3, where the rods are individually pivotably connected to an axle, so that the rods during the motion of the slide towards the stoking channel may be swung in the direction of motion and upwards, the straw may unhindered be conveyed into the stoking channel by the leading edge of the slide as well as by the knives, whereas the return movement of the slide will cause the rods to swing downwards thereby retaining the torn-off straw in the stoking channel.

By giving the slide such an planar extension that the straw bale always will rest on upper side of the slide as described in claim 4 the tendency that straw is brought along with the return movement of the slide is counteracted.

A further preferred embodimentt detail is indicated in claim 5, where the device is provided with upstanding, elongated fins extending in the direction of motion on the rear part of the slide. In this way the straw bale will be kept raised during the return movement of the slide and not be lowered until the teeth are under the straw bale.

In a still further embodiment as indicated in claim 6 there is provided a second retaining means at the lower edge of the shaft farther from the stoking channel and in the shape of a plate piece with slits allowing passage for the fins. Thereby, also, comminuted straw is retained in the shaft during the return movement of the slide.

An embodiment of the device according to the invention will described in the following with reference to the drawing, where

Fig. 1 is a sectional view of a device according to the invention, where the slide is moving forward, and with an enlarged detail view of the foremost rods during the advance of the slide respectively during its return,

Fig. 2 shows the slide with teeth and fins seen in an elevated perspective view.

Fig. 1 shows an embodiment of the device according to the invention comprising a straw bale magazine 11 or hopper in the shaft 16 of which one or more straw bales 17 may be contained.

The bottom of the shaft 16 has a mouth above the shredding unit, which comprises a slide 1 with an upper plate 3 forming the top plate of the slide, see fig. 2.

The plate 3 is designed as a rectangular frame to form a box of which the front edge forms a piston means 7.

Under this box is mounted a hydraulic cylinder 4 attached to the stationary part of the shredding unit, while the piston rod 5 of the cylinder 4 is attached to the piston means 7 of the slide.

Onto the upper side of the plate 3 there are welded teeth 2 which, as it appears especially from fig. 2, are mutually staggered so that the teeth 2 will stroke the whole end surface of the straw bale 17 in its entire width as the slide 1 advances towards the channel 12.

Moreover, in the part farther from the stoking channel 12 several elongate upstanding fins 6 are mounted parallely with the direction of motion of the slide 1, the fins 6 having a height above the plate 3 approximately as the teeth 2. The teeth 2 consists of rectangular triangle elements, e.g. of cut-out steel plates welded to the plate 3, the one cathete of the triangle forming the off-tearing edge facing the channel 12.

Below the shaft 16 at the side closest to the stoking channel 12, as it appears from the enlarged detail view, there are mounted a number of rods 8 individually suspended on a horizontal axle 9. By this the rods 8 may pivot forward and upwards, singly or jointly, as the slide is advancing, see the upper detail, and be swung down into the vertical position when the slide returns, as it appears from the lower detail.

At the bottom edge of the shaft 16 by the side farthest from the channel 12 there is mounted a plate 10 with slots in which the fins 6 can slide, the plate 10 acting as retaining means for the straw in the shaft 16.

The distance between adjacent rods 8 are adapted to the width of the tooth elements 2, so that the teeth 2 and thus the slide 1 can be moved forward and backwards between the rods 8 from a position where the foremost teeth 2 are under the straw bale 17 to a position where the rearmost edge of the slide is close to the backside of of the plate 10.

When a straw bale 17 is put into the magazine 11 it will fall down and rest against the knives 2 and the plate 3. By activation of the cylinder 4 to start a reciprocating working cycle the piston rod 5 will cause the slide 1 to reciprocate.

During the advance movement of the slide 1 the knives 2 will partly cut possible binder twine and partly move forward through the bottom layer of the bale 17.

By this the straw will be torn up by the knives 2 and be carried forward under the rods 8, which will be swung upwards by the torn-off straw.

As the tearing-up progresses by the reciprocating movement of the slide 1, the torn-off straw 18 will be pressed forward in the stoking channel 12 by the piston means 7, where the straw 18, according as the form of the channel, will be compressed and fed into a combustion chamber 15, e.g. onto a grate 13 in a boiler 14.

It will be noticed that the straw bale 17 during the return of the slide first will be kept up by the fins 6 and next by the teeth 2 which due to their shape easily can be drawn back under the the straw bale. When the slide is pushed forward, the straw bale 17 will sink down onto the slide, so that the teeth 2 at once will touch the straw which consequently will be torn up in a hitherto unknown effective way from the very start of the movement.

Through a suitable operation of the hydraulic piston 4 and depending on the needed effect of the boiler, a very high useful effect may be achieved at a relatively low energy consumption by the piston 4.

The device according to the invention may be varied in a number of ways within the scope of the claims.

Claims

1. Device for tearing up and stoking straw into a combustion chamber (15) and comprising an essentially vertical magazine shaft (16) for straw bales (17) below which shaft (16) there is provided an essentially horizontal slide (1) capable of a reciprocating motion from a position vertically below the shaft (16) and into a stoking channel (16) and back again, **characterized** in that the slide (1) is provided with teeth (2) provided as single upward-facing elements mounted on the slide (1), the teeth (2) being mutually staggered in the direction of movement of the slide (1).

2. Device according to claim 1, wherein by the part of the lower edge of the shaft (16) closest to the stoking channel (12) there is provided rods (8) projecting down towards the slide (1) and in such a way that the teeth (2) can pass between the rods (8,10).

3. Device according to claim 2, wherein the rods (8) are individually pivotably connected to an axle (9), so that the rods (8) during the motion of the slide (1) towards the stoking channel (12) may be swung in the direction of motion and upwards.

4. Device according to claims 1 to 3, wherein the slide (1) is positioned and dimensioned in such a way that the slide (1) extends under the shaft (16) in both extreme positions of its reciprocating movement.

5. Device according to claims 1 to 4, wherein the end of the slide (1) farthest from the stoking channel (12) is provided with a number of upwardly projecting, elongated fins (6) extending in the direction of movement of the slide (1).

6. Device according to claim 5, wherein by the part of the lower edge of the shaft (16) farthest from the stoking channel (12) there is provided second retaining means in the shape of a downwardly projecting piece of plate (10) traversing the direction of movement of the slide (1), the plate (10) having downwardly open slits dimensioned and positioned as to allow the passage of the fins (6).

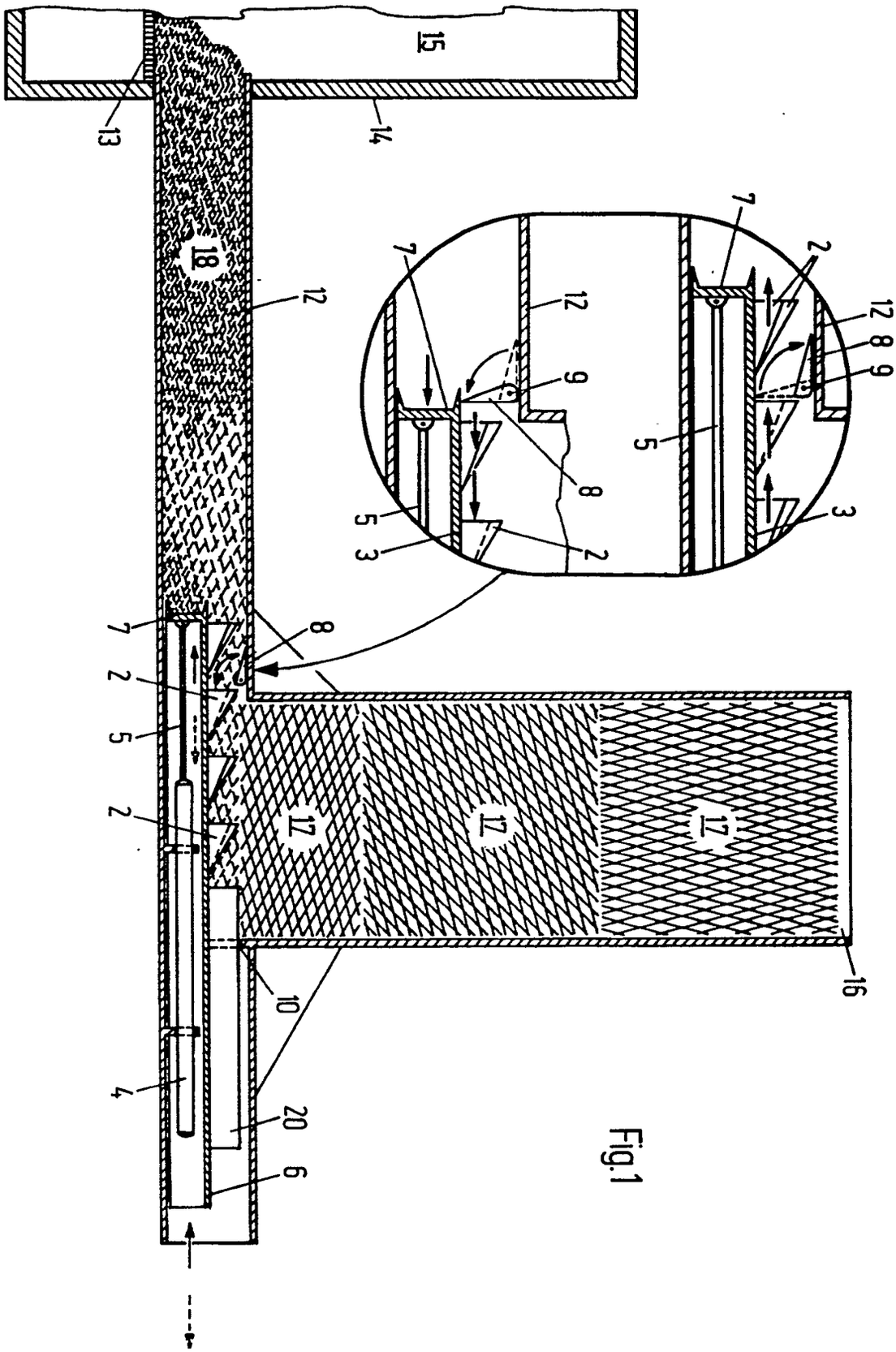

Fig.1

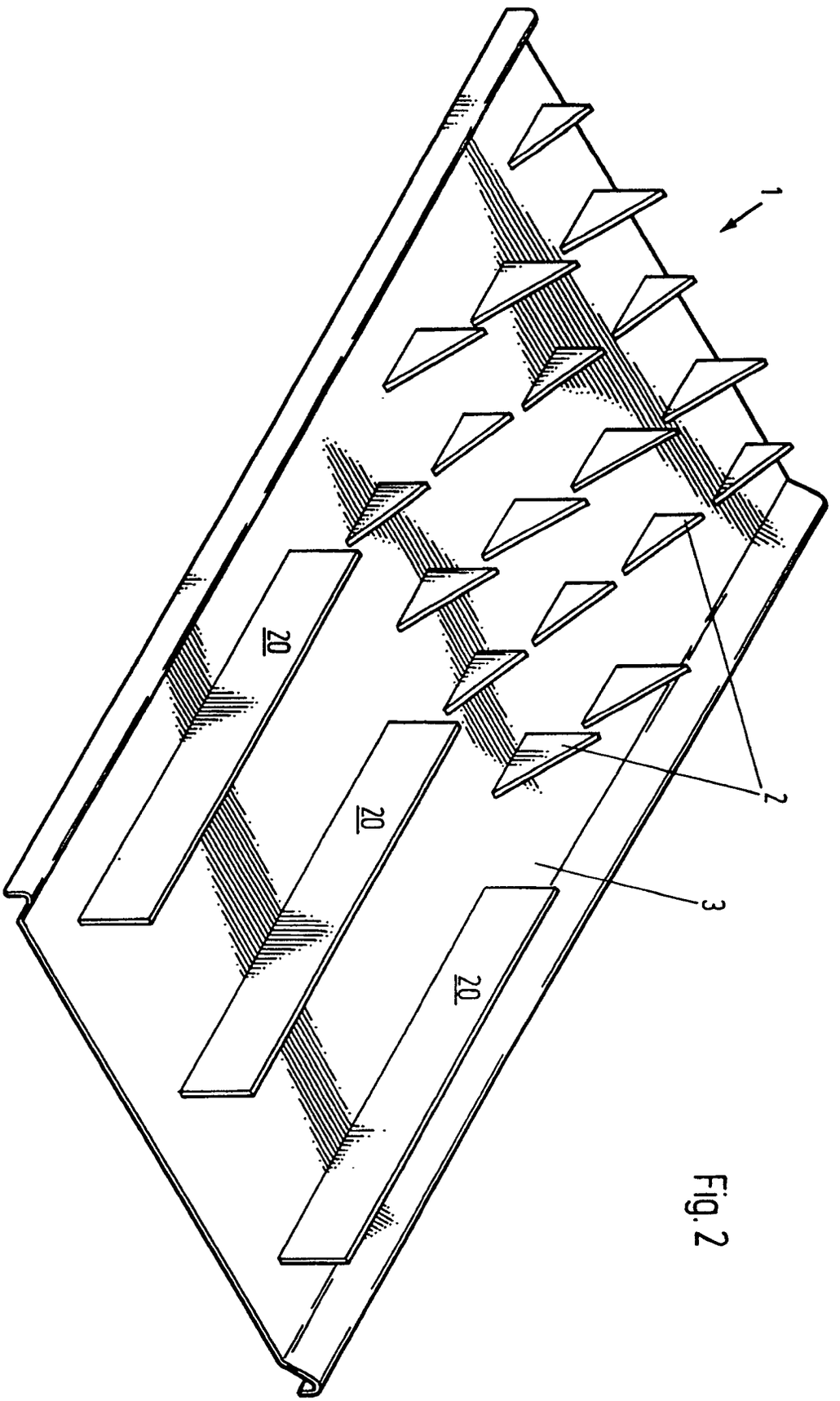

Fig. 2